

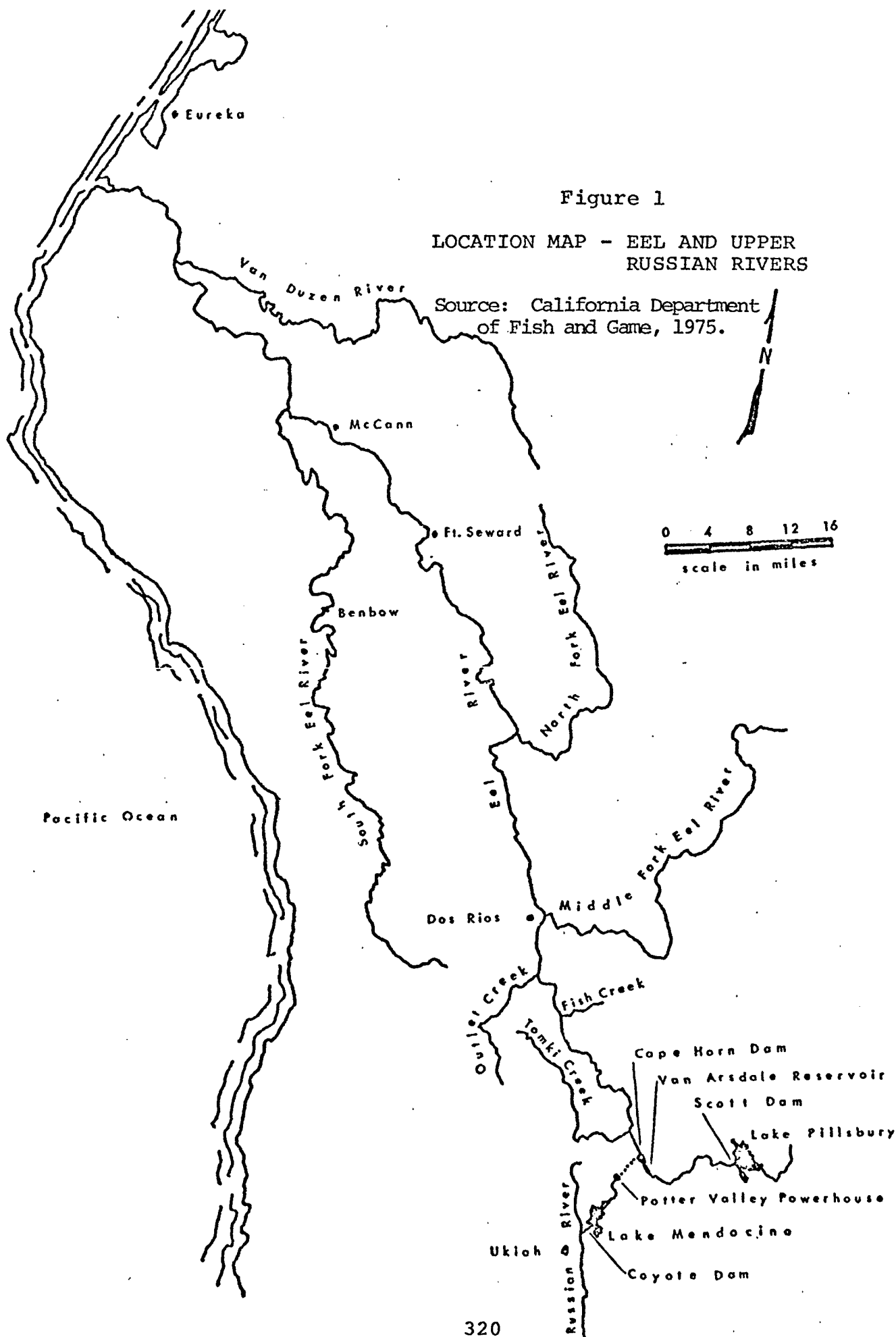
CASE STUDY REPORT #14  
CAPE HORN DAM  
EEL RIVER

I. Project Description

The main stem of the Eel River flows in a northwesterly direction over 100 miles entering the Pacific Ocean about 15 miles south of Eureka, California (see Figure 1). Near its headwaters is Cape Horn Dam, completed in 1907 by Snow Mountain Water and Power Company. Van Arsdale Reservoir, impounded by Cape Horn Dam, has a storage capacity of 700 acre-feet and covers 163 acres.

In 1908 the company began diverting water from this project through a tunnel to a powerhouse in Potter Valley. Eel River water is then discharged from the Potter Valley Powerhouse into the East Fork of the Russian River (see Case Study Report #15). Fish populations in that portion of the Eel River upstream of Outlet Creek were significantly affected by this dam (see Figure 1).

In 1922 Scott Dam, impounding Lake Pillsbury, was completed and is located 11 miles upstream on the Eel River from Cape Horn Dam. This dam stabilizes and increases the company's water supply for operation of the Potter Valley Powerhouse. Water is also provided to the Potter Valley Irrigation District. All of these facilities comprise the Potter Valley power complex which has reduced the salmon and steelhead fishery in the Eel River.



During the year Scott Dam was constructed, the Federal Power Commission (FPC) issued a 50-year license (FPC 77) for the Potter Valley power complex. This license was to be renewed in 1972 and the project development portion of this study responds to the period before relicensing, which is still in process.

In 1930 the Pacific Gas and Electric Company (PG&E) acquired Snow Mountain Water and Power Company and its Potter Valley complex along with accompanying Eel River water rights and the FPC license. The water rights consist of all flows except for a minimum 2 cubic feet per second (cfs) to be released at all times from Cape Horn Dam to assure prior downstream water rights.

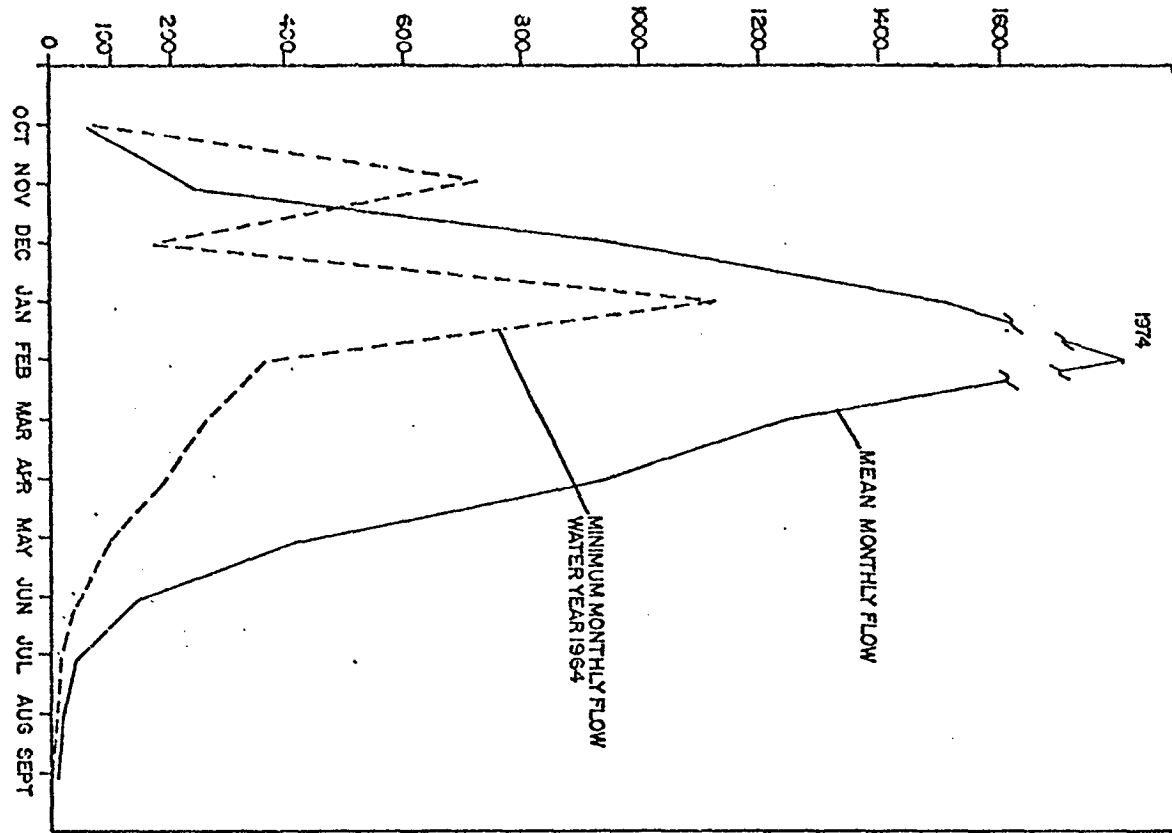
PG&E enlarged and modified sections of the diversion tunnel to Potter Valley in 1950. The tunnel has the capacity to divert 400 cfs while the powerhouse capacity is 355 cfs.

The average discharge of Eel River water at the Potter Valley tailrace for 63 years (1910-73) was 202 cfs (USGS, 1973).

## II. Pre-Project Conditions

The flow regime in the main stem of the Eel River has been affected by Cape Horn Dam since 1908. The pre-project hydrograph (Figure 2) shows unimpaired (natural) flows calculated from estimated runoff in the Upper Eel River (Department of Water Resources, 1969). The calculated unimpaired 1964 (dry year) flow is shown for comparison to the mean monthly flow.

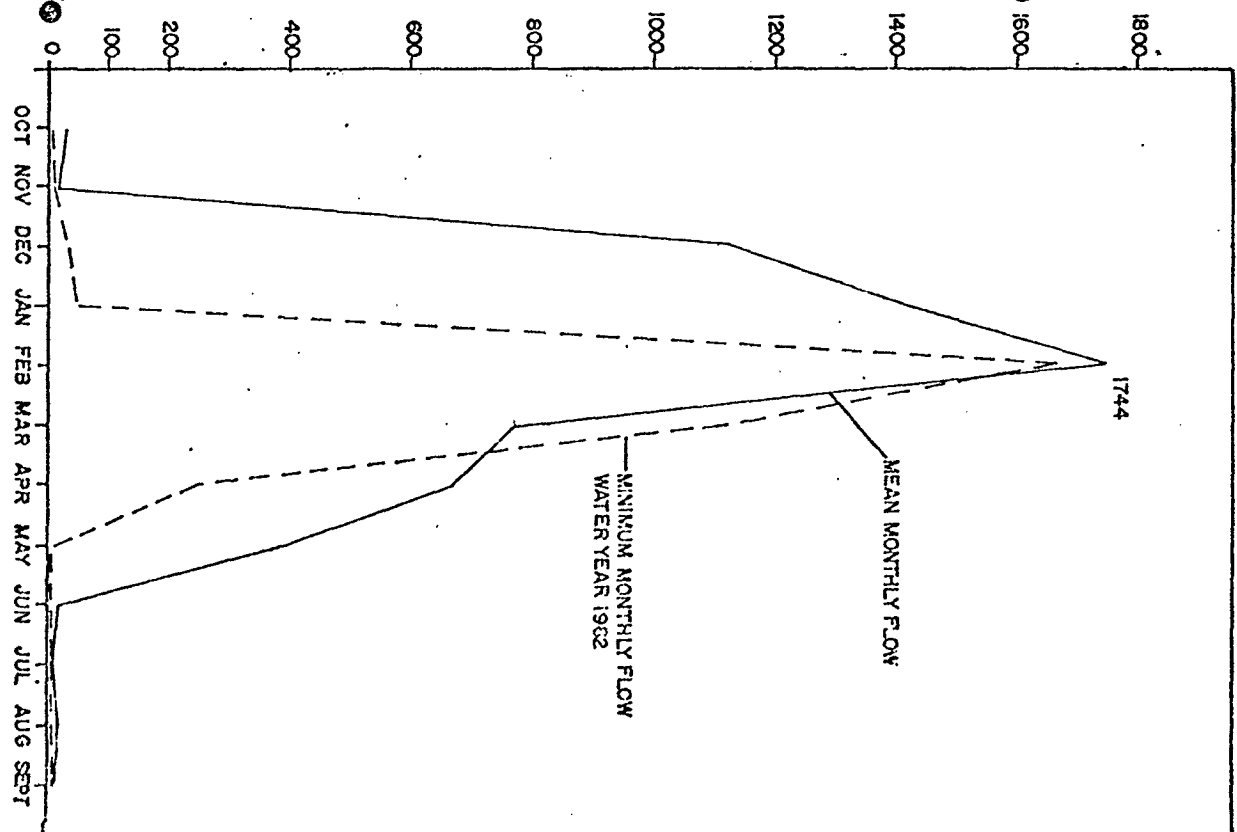
223 STREAMFLOW (CFS)



PRE-PROJECT: OCTOBER 1911 - SEPTEMBER 1960  
GAUGE STATION NO.  
SOURCE: DEPARTMENT OF WATER RESOURCES

FIGURE 2  
STREAMFLOW CONDITIONS, EEL RIVER  
CAPE HORN DAM,  
VAN ARSDALE RESERVOIR

STREAMFLOW (CFS)



POST-PROJECT: OCTOBER 1950 - SEPTEMBER 1965  
GAUGE STATION NO. 11471500  
SOURCE: USGS WATER SUPPLY PAPER 1735

Sixteen species of fish are reported to be in the Eel River drainage (Brown and Haley, 1974) and six of these are introduced species (see Table 1). Among the sport and commercial fish, king salmon and steelhead were historically abundant in the Eel River upstream of Outlet Creek. Although there is no record of species composition or abundance, the Department of Fish and Game estimated (1972) that the number of adult king salmon passing above Cape Horn Dam was about 4,000 annually. The number of steelhead was probably of about the same magnitude. Nothing was discovered concerning the non-game species.

### III. Project Development

The project development analysis is restricted to the 1908 construction of Cape Horn Dam (Van Arsdale Reservoir). Thereafter is a continuing pattern of change in the project in response to both fishery and other water needs which are part of the post-project period.

In the initial development of the project, consideration was given to the need for salmon and steelhead to pass the dam to reach historical spawning areas. About 60 miles of stream above Cape Horn Dam were available for this purpose. A fish ladder was constructed to provide fish passage. One may speculate that the overflow water and the 2 cfs minimum release to satisfy downstream water rights was deemed sufficient for fish passage. However, no record was found to document project considerations given to the conservation of salmon and steelhead.

Table 1

KNOWN ANADROMOUS AND FRESHWATER FISH SPECIES PRESENT  
IN THE EEL RIVER DRAINAGE

Common Name	Scientific Name
Pacific lamprey	<u>Entosphenus tridentatus</u>
Green sturgeon	<u>Acipenser medirostris</u>
* American shad	<u>Alosa sapidissima</u>
King salmon	<u>Oncorhynchus tshawytscha</u>
Silver salmon	<u>Oncorhynchus kisutch</u>
Steelhead trout	<u>Salmo gairdneri</u>
Coastal cutthroat trout	<u>Salmo clarki</u>
* Sacramento western roach	<u>Hesperoleucus symmetricus</u>
* Golden shiner	<u>Notemigonus crysoleucas</u>
Western sucker	<u>Catostomus occidentalis</u>
* Brown bullhead	<u>Ictalurus nebulosus</u>
Threespine stickleback	<u>Gasterosteus aculeatus</u>
* Green sunfish	<u>Lepomis cyanellus</u>
* Bluegill	<u>Lepomis macrochirus</u>
Aleutian sculpin	<u>Cottus aleuticus</u>
Prickly sculpin	<u>Cottus asper</u>

\* Introduced species.

Source: Department of Fish and Game, 1975.

The department stated (1975) "that total restoration of the Eel River to pre-project fishery conditions cannot be accomplished under any alternative that is compatible with continued operation of the Potter Valley Powerhouse". Presently there has been no action taken by the FPC on relicensing of FPC 77 or the recommendations pertaining to its operation (Baker, pers. comm.).

#### IV. Post-Project

The Eel River system supports average annual spawning runs of 89,000 salmon and 99,000 steelhead (Department of Water Resources, 1972). The peak run of salmon for a single year was estimated at 177,000 in 1965 by the Department of Fish and Game. Historically about 3,000-4,000 salmon and steelhead may have used the area upstream of Cape Horn Dam for spawning and rearing. This represents approximately 4 percent of the estimated runs.

After construction of Cape Horn Dam in 1907, the Department of Fish and Game began operating an egg collecting station (Snow Mountain Station) and a fishway at the dam. Spawning operations began in 1909 and continued through the 1959 spawning run (see Table 2). During this time, Scott Dam was constructed (1922) 11 miles upstream and greatly altered the upstream habitat.

The fishway provided at the dam functioned poorly and an unknown but presumably large percentage of the annual anadromous fish runs failed to pass over the dam. The fishway has been

TABLE 2

## Fish Counts at Snow Mountain Station

## Cape Horn Dam, Mendocino County

<u>Year</u>	<u>Steelhead</u>	<u>King Salmon</u>
1933 - 34	3,247	- - -
1934 - 35	2,255	- - -
1935 - 36	6,310	- - -
1936 - 37	6,861	- - -
1937 - 38	3,413	- - -
1938 - 39	4,786	- - -
1939 - 40	3,889	- - -
1940 - 41	2,225	- - -
1941 - 42	- - -	- - -
1942 - 43	- - -	- - -
1943 - 44	- - -	- - -
1944 - 45	9,528	- - -
1945 - 46	5,054	- - -
1946 - 47	4,409	917
1947 - 48	178	994
1948 - 49	2,433	- - -
1949 - 50	- - -	- - -
1950 - 51	1,091	55
1951 - 52	5,444	- - -
1952 - 53	2,197	- - -
1953 - 54	2,590	- - -
1954 - 55	6,131	- - -
1955 - 56	3,719	5
1956 - 57	4,109	0
1957 - 58	5,151	2
1958 - 59	3,335	0
1959 - 60	2,206	0
1960 - 61	1,130	9
1961 - 62	1,693*	0
1962 - 63	2,030*	9
1963 - 64	846	3
1964 - 65	921*	63
1965 - 66	423	94
1966 - 67	534	148
1967 - 68	531	0
1968 - 69	340	0
1969 - 70	720	15
1970 - 71	1,863	34
1971 - 72	696	0

\* Incomplete counts

Source: Department of Fish and Game, 1975.



modified on several occasions to raise the percentage of fish passage over the structure. Presently the Department of Fish and Game estimates that the fish passage efficiency during optimal operational flows is about 90 percent. The minimum release of 2 cfs from Cape Horn Dam, to satisfy downstream water rights, does not allow the upstream migration of king salmon to the fishway in the absence of early fall rains; however, steelhead arrive at the dam when flow conditions are favorable.

Records of fish counts taken at the Snow Mountain Station began in 1933 (Table 2). For two years of record (1946 and 1947), 917 and 994 king salmon, respectively, were spawned at the Snow Mountain egg taking facility. For the latest 16 years of record (1956 to 1972), the average annual king salmon run has been 22 salmon with a range of 0 to 148 salmon recorded. The area between Van Arsdale Reservoir and the Middle Fork Eel River, excluding Outlet Creek, was estimated to historically support 8,000 king salmon and 11,000 steelhead spawners annually (California Department of Fish and Game, 1965). Silver salmon have been observed on only one occasion at the Snow Mountain Station.

The first king salmon in the Upper Eel River are usually observed in late October and early November. Migrating king salmon usually stop in their upstream migration at the mouth of Outlet Creek, 31 miles downstream from Cape Horn Dam due to insufficient streamflows for passage and stimulus for upstream migration (California Department of Fish and Game, 1975).

The records of steelhead ascending the Cape Horn Dam fishway begin in the year 1933. During this period, steelhead spawners have shown a general decline in numbers, with the greatest decline occurring from the winter of 1957-58 through 1968-69. A high of 9,528 steelhead was recorded in the winter of 1944-45, and a low of 340 in 1968-69 (see Table 2).

The first heavy rains creating runoff at Tomki Creek and occasional spills at Cape Horn Dam provide the necessary stimulation for passage from the mouth of Outlet Creek farther upstream to Tomki Creek which is located 3.6 miles below Cape Horn Dam. It is extensively used by spawning salmon and steelhead. Stream surveys conducted by the U. S. Fish and Wildlife Service and the Department of Fish and Game from 1965 through 1969 indicate annual runs of about 3,000 king salmon and 2,500 steelhead use the Tomki Creek drainage.

The short-term spills that occur at Cape Horn Dam are a result of the inability of the reservoir to contain accretion flows from its drainage between the two dams. These flows can stimulate king salmon to move upstream past the confluence of Tomki Creek to the fishway at Cape Horn. Often the spills are short in duration and the salmon become stranded or their redds are exposed when the flows are once again regulated at the dam.

Minimum transportation flows to allow fish to cross shallow riffles between Tomki Creek and Van Arsdale Reservoir should be maintained at 100 cfs below Cape Horn Dam beginning November 1 (California Department of Fish and Game, 1975). Flows of this

magnitude generally do not occur below the dam in November. At minimum flow years, no transportation flows occur during the spawning season as shown on the post-project hydrograph (Figure 2). Table 3 illustrates the seasonal loss of water from the Eel River due to the Potter Valley project.

The Upper Eel River between Cape Horn Dam and Outlet Creek have a decreasing reservoir of spawning gravel. Scott and Cape Horn Dams have prevented accretion of gravels from the upper drainage, thus preventing the replenishment of spawning gravel. The availability of the existing gravels for fish spawning has also been reduced because of the encroachment of riparian vegetation onto the floodplain above Tomki Creek, and to a lesser extent below Tomki Creek (California Department of Fish and Game, 1975). This type of vegetative encroachment physically alters spawning gravel, reduces water velocities, aids in the sedimentation process and reduces intergravel water flows, all of which influence successful salmon spawning.

Furthermore, the accumulation of fine sediments in Van Arsdale Reservoir was periodically sluiced downstream through the outlet pipe prior to 1973. Apparently this was done to aid in efficient diversion of water and to comply with safety regulations. This action distributed sediment for a distance of 2 miles below the dam. Currently the reservoir is periodically dredged of the sediments originating in the Lake Pillsbury drainage basin, thus eliminating the need to use the outlet pipe for sediment removal.

TABLE 3

Comparison of Mean Monthly Unimpaired and Actual Runoff  
of the Eel River at Cape Horn Dam for 50-year Period,  
1911 through 1960

Month	Unimpaired Runoff A-F (CFS)		Impairment A-F (CFS)		Actual Runoff A-F (CFS)		Percentage Reduction
Oct.	2,980	(49)	2,480	(41)	500	(8)	83.2
Nov.	15,220	(256)	10,210	(172)	5,010	(84)	67.1
Dec.	57,940	(944)	21,680	(353)	36,260	(591)	37.4
Jan.	92,640	(1509)	22,020	(358)	70,620	(1151)	23.8
Feb.	109,460	(1974)	22,280	(401)	87,180	(1573)	20.4
Mar.	76,300	(1243)	20,300	(330)	56,000	(913)	26.6
Apr.	56,050	(944)	18,780	(315)	37,270	(629)	33.5
May	26,130	(426)	14,670	(239)	11,460	(187)	56.1
June	9,080	(153)	7,750	(131)	1,330	(22)	85.4
July	2,560	(42)	2,350	(38)	210	(4)	91.8
Aug.	1,060	(17)	840	(14)	220	(3)	79.2
Sept.	860	(14)	630	(11)	230	(3)	73.2
Year	450,280	(622)	143,990	(199)	306,290	(423)	32.0

Source: Eel and Mad River Basins Master Plan - Hydrology, Department of  
Water Resources, August, 1969.

Steelhead spawning and nursery habitat between the two dams is estimated at 29.6 miles, of which 11.5 miles occurs on the main stem and 18.1 miles in the tributary streams. Also 31 miles of stream between Cape Horn and Outlet Creek is impacted by project streamflows as indicated by the data in Table 2. The project has seriously depleted king salmon and steelhead resources in the Upper Eel River above Outlet Creek.

In 1959 the Sonoma County Flood Control and Water Conservation District (now the Sonoma County Water Agency) and the Russian River Flood Control and Water Conservation District applied for appropriative water rights in the amount of 345 cubic feet per second by direct diversion from the Eel River. These applications were subsequently held in abeyance by the State Water Resources Control Board pending the FPC's decision on the relicensing of PG&E's Potter Valley project.

In April 1970, PG&E applied for a new 50-year license that proposed to maintain existing operational procedures for the project which included a minimum flow of 2 cfs in the Eel River. The Department of Fish and Game submitted a report to the FPC recommending that certain flow releases and changes in operating procedures be incorporated into the terms of the new FPC license. These recommendations were primarily designed to help solve the major fishery problems associated with the project, such as dewatering of the Eel River and rehabilitating the anadromous fisheries of the Eel River.

In April of 1972 FPC license No. 77 originally issued to Snow Mountain Water and Power Company in 1922 expired. Since 1972 PG&E has continued operation of the project (FPC 77) under annual renewals of the old license.

In about 1974, as a result of the various demands being placed on Eel River water, Humboldt County and the Eel River Water Council requested a study to investigate ways of improving flows in the Eel River for the enhancement of fisheries and recreation. An Interagency Study Committee was organized to direct the study. The committee consisted of the Eel River Water Council, Humboldt, Mendocino, Sonoma and Lake Counties, Russian River Flood Control and Water Conservation District, Sonoma County Water Agency, North Marin County Water District, PG&E, the U. S. Forest Service, U. S. Army Corps of Engineers, U. S. Bureau of Reclamation and U. S. Bureau of Sport Fisheries and Wildlife, and the California Departments of Water Resources and Fish and Game.

The Department of Fish and Game was charged with estimating present fish populations, migration patterns, angler use, summarizing existing fishery problems, and estimating the effects and benefits of various alternative operational plans for the Potter Valley system.

Six operational alternatives were chosen by the Inter-agency Study Committee. The alternatives selected by the study committee are:

- "1. Evaluation of leaving the existing system and operation 'as is'.
- "2. Reoperation of existing Lake Pillsbury-Potter Valley-Lake Mendocino complex to augment flows in the Eel River without substantially adversely affecting beneficial uses within the Russian River Basin.
- "3. Reoperation of existing Lake Pillsbury and enlarged Lake Mendocino to provide increased streamflow for fisheries enhancement and summer recreation in the Eel River without necessitating severe restriction in output of Potter Valley powerplant.
- "4. Reoperation of Lake Pillsbury, enlarged Lake Mendocino, an enlarged Potter Valley tunnel, and abandonment of the Potter Valley Powerhouse, to provide enhancement of the fishery and summer recreation in the Eel River, while meeting present and future recreation and consumptive water needs in the Russian River Basin.
- "5. Reoperation of the existing Lake Pillsbury-Lake Mendocino system with abandonment of Potter Valley Powerhouse to provide the minimum diversion to the Russian River that is necessary to maintain present beneficial uses and streamflow requirements and provide increased flows for fisheries enhancement and summer recreation in the Eel River.
- "6. Evaluation of the impact on both the Eel and Russian River basins of closing off the diversion tunnel."

The Department of Fish and Game published the Eel-Russian Rivers Streamflow Augmentation Study Reconnaissance Fisheries Evaluation in February 1975. This report evaluates six alternatives and makes recommendations regarding the fishery preservation aspects of FPC 77.

Actions recommended by the Department of Fish and Game's February 1975 report are:

- "1. The State of California, in cooperation with appropriate local and federal governmental bodies, initiate 'feasibility level' evaluations of Alternatives 4, 5 and 3 to determine if the project should be recaptured and/or portions enlarged (Lake Mendocino and tunnel) with the expressed purpose of providing increased fisheries, recreation and other benefits to the Eel River system while protecting or augmenting Russian River consumptive water uses.
- "2. The Federal Power Commission grant to Pacific Gas and Electric Company as soon as possible a project operation license containing the following provisions:
  - A. A license period of ten years to allow time for consideration and possible change to operation Alternative 4, 5 or 3 after results are available from the feasibility study requested above.
  - B. A salmon and steelhead hatchery be designed, constructed and maintained at licensee's expense to provide partial mitigation of the project's impacts. The hatchery size and design must be approved by the Department and U. S. Fish and Wildlife Service. Department of Fish and Game would operate the facility. In the event of license recapture following the 10-year license period, then PG&E would be reimbursed for capital outlay for the hatchery by the agency or party assuming responsibility for the project facilities.
  - C. Maintenance of the following minimum flow releases to help restore the anadromous fishery resources of the Eel River affected by the Potter Valley Project and to maintain the Russian River fisheries [see Table 4].
  - D. A cooperative PG&E, Department of Fish and Game, U. S. Fish and Wildlife Service study be initiated to improve timing of downstream salmonid migration by manipulating river temperatures through reservoir water spills and releases. Positive results of the study should be implemented immediately thereafter."



Table 4  
RELEASES TO THE EEL RIVER FROM CAPE HORN DAM

Month	Total Release	Anticipated Release Pattern*
November	8,923 AF	150 cfs
December	9,221 AF	150 cfs
January	9,221 AF	150 cfs
February	8,329 AF	150 cfs
March 1-15	7,436 AF	250 cfs
March 16-31	7,141 AF	250-200 cfs
April	9,124 AF	200-107 cfs
May	3,585 AF	107-10 cfs
June	505 AF	10 cfs
July	615 AF	10 cfs
August	615 AF	10 cfs
September	505 AF	10 cfs
October	<u>615 AF</u>	10 cfs
TOTAL	65,835 AF	

\* This schedule may be altered as needed for fisheries purposes, but releases would not exceed the recommended total acre-feet block of water by month.

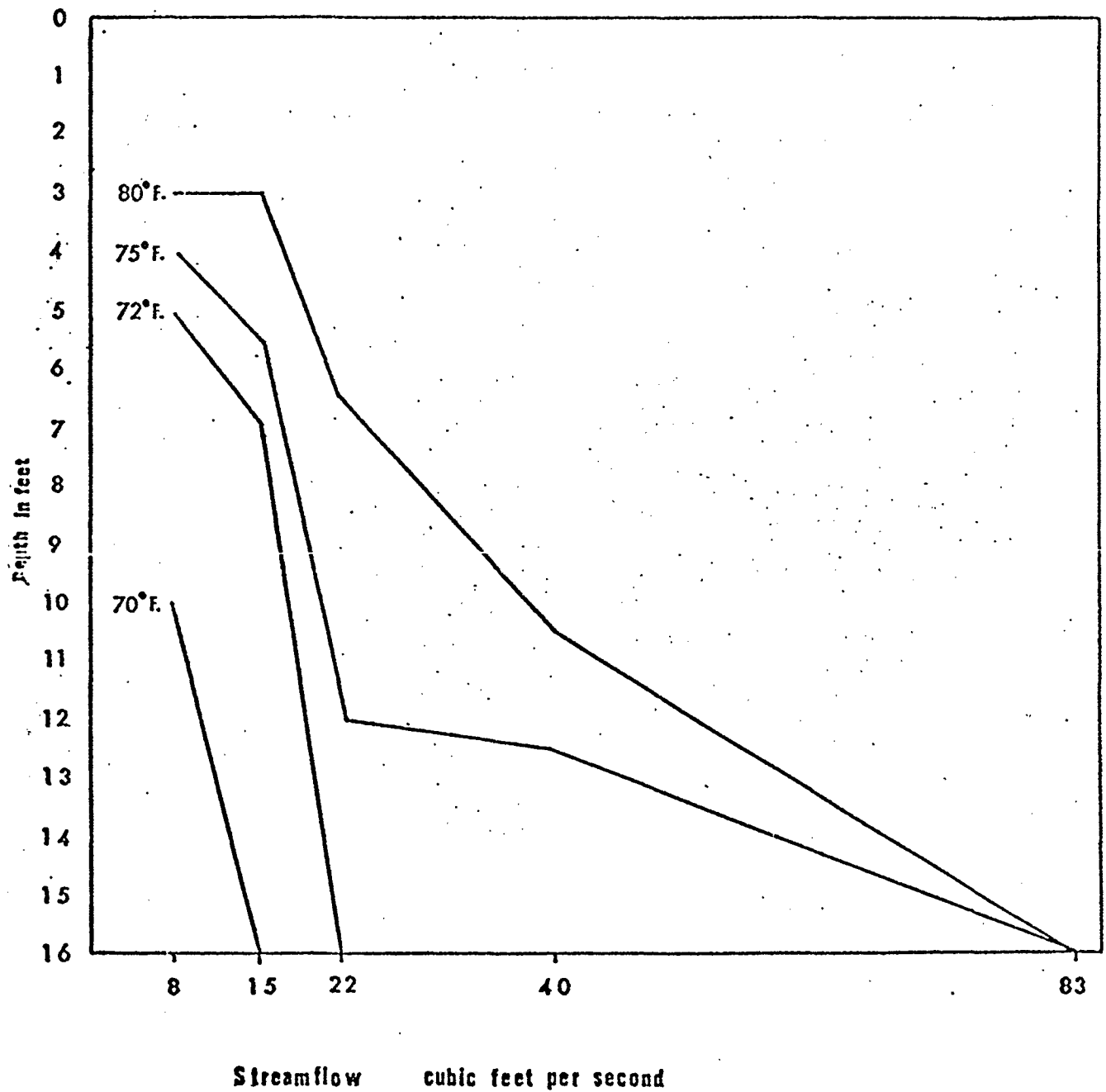
Source: California Department of Fish and Game, 1975.

In response to the foregoing activities, Department of Fish and Game conducted a study to determine water temperature-streamflow relationships in the Eel River between Scott Dam and Outlet Creek. Thermographs were placed in the deeper pools, one near the surface and one near the bottom. The flows below Cape Horn Dam that were studied were: 5.6, 22, 40 and 82 cfs.

The study showed that at a streamflow of 5.6 there was thermal stratification in pools during the warmest part of the day (80 to 87°F surface temperature). A lower layer of cool water (about 75°F) provided habitat for salmonids so they could escape from lethal temperatures that were present in the uppermost layers. The occurrence of this temporary thermal stratification depended upon cool overnight temperatures (66 to 75°F) and low streamflows. At streamflows greater than the 5.6 cfs monitored the pool stratification broke down and the volume of cool bottom water capable of supporting salmonids decreased, until at 83 cfs daytime temperatures exceeded 80°F at all depths (see Figure 3). The diurnal changes in air temperature had less effect on water temperatures as flow from the reservoir increased.

The present recommended flow release schedule was formulated by the Department of Fish and Game to improve in-stream conditions and help rehabilitate the spawning habitat. The recommended fall and winter in-stream flow release is designed to provide adequate fish passage and stimulate upstream migration.

Figure 3



Average maximum daily water temperatures in a stratified pool on the Eel River near the confluence of Fish Creek at various streamflows, July 19 through August 6, 1973.

Source: California Department of Fish and Game, 1975.

The recommended springtime releases at Cape Horn Dam are important to ensuring proper timing of the downstream migration of juvenile salmon and steelhead trout. According to the release schedule (see Table 4) between March 1 and March 15, 250 cfs are to be released and gradually diminish at a constant rate to 20 cfs by May 31. The 20 cfs in-stream flow is recommended throughout the summer.

This summer flow increase from 2 cfs to 20 cfs would recreate the more favorable pre-project flow regime. A feature of the recommended 20 cfs is that it provides for stratification of temperatures in pools along the main river. The volume of cooler water provides refuge for salmonids from the high lethal summer temperatures.

Until the FPC rules on the relicensing of the Potter Valley Power Complex (FPC 77), PG&E will continue to operate on the old release of 2 cfs during minimum flow years in the late summer and early fall months of the year.

## V. Conclusion

Diversion of Eel River water at Cape Horn diversion dam to the Potter Valley power house on the headwaters of the Russian River has reduced and periodically dewatered the Eel River below the dam. From the start in 1907, no official recognition was given to instream flow reservations for the conservation of important anadromous and resident fisheries

resources. As a result of the present operating procedures at Cape Horn Dam, king salmon runs have been virtually eliminated and steelhead runs are on the decline. Unless new flow reservations are instituted, this decline will continue and ultimately result in an almost complete loss of the runs in the Eel River upstream of Tomki Creek.

The Federal Power Commission is in the process of relicensing PG&E's Potter Valley power project which determines the operation of Cape Horn diversion dam in conjunction with Scott Dam, the Potter Valley transbasin tunnel and power house. The relicensing process was initiated in 1972, but no decisions have been made regarding the operation of the project or the rehabilitation and maintenance of fish and wildlife resources. The entire project presently operates under an annual license.

Since 1972 the Department of Fish and Game has conducted two investigations (Department of Fish and Game, 1972 and 1975) which included usable width transect studies, temperature and instream studies to recommend minimum instream flow reservations and the operational alternatives best suited to the preservation of fish and wildlife. Six alternative modes of operation for the Potter Valley project were proposed and are being evaluated by the Eel-Russian River's streamflow augmentation Interagency Study Committee whose members include the Department of Fish and Game, along with other public and private agencies. The PG&E has proposed that existing operational procedures of the

project be the alternative chosen for relicensing while the Department of Fish and Game has stated that "total restoration of the Eel River to pre-project fishery conditions cannot be accomplished under any alternative that is compatible with the continued operation of the Potter Valley power house".

The Eel River has many demands being placed on it from the Russian River basin. There are power production demands at Potter Valley and irrigation and urban demands farther downstream. The situation in 1959, as described by the State Water Resources Control Board at the Sonoma County Water Agency Water Rights Application Hearing, was "that irrigation has continued to increase steadily until the present time and is dependent to a considerable extent on the importation of Eel River water. Urban development with related industry has kept pace with agriculture. The Towns of Ukiah, Hopland, Healdsburg and Cloverdale, to name the larger ones, are examples of this urban growth and are also dependent to a large extent on the continued availability of Eel River water". This situation can only make Eel River flow augmentation for fisheries rehabilitation and maintenance more difficult.

Because the operational procedures of the Potter Valley project have remained unchanged, to date, it is not possible to analyze the Department of Fish and Game's recommendations or the methods used to determine minimum instream flow.

## BIBLIOGRAPHY

### Personal Communications

- Baker, Philip. 1976. California Department of Fish and Game, Region 3.
- Baracco, Allen. 1976. California Department of Fish and Game, Region 3.
- Emig, John. 1976. California Department of Fish and Game, Region 3.
- Fraser, Jack. 1976. California Department of Fish and Game, Region 3.
- Jones, Weldon. 1976. California Department of Fish and Game, Region 3.

### References

- California. Department of Fish and Game. 1972. Report to the Federal Power Commission on the fish and wildlife aspects of the relicensing of the Potter Valley hydroelectric development. 59 pp.
- . 1975. Eel, Russian River streamflow augmentation study: fisheries evaluation. Report to the Interagency Task Force. 61 pp.
- California. Department of Water Resources. 1965. North coastal investigation, appendix C - fish and wildlife. Bulletin no. 136. 364 pp.
- . 1969. Eel and Mad River basins, California. Master plan - hydrology. California State Federal Interagency Study Group.
- . 1972. Alternative Eel River projects and conveyance routes.
- Day, J. S. 1968. A study on downstream migration of fish past Cape Horn Dam on the Upper Eel River, Mendocino County. Department of Fish and Game Marine Resources Administrative Report 68-4.
- U. S. Fish and Wildlife Service. 1960. Natural resources of northwestern California. A preliminary survey of fish and wildlife resources. 104 pp.
- U. S. Geological Survey. 1971. Turbidity and suspended sediment transport in the Russian River basin, California. 29 pp.